Dynamics of General Functional Characteristics of an Individual in the Process of Chess Training

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Abstract

Regular mental exercises are currently considered an important component of the rehabilitation of various categories of patients with organic brain disorders. The study was carried out with the help of the Russian Internet portal "Chess Planet", which makes it possible to obtain information about persons with disabilities in the course of their sports training. The study involved 28 people with cerebral palsy at the age of 19-27, out of whom 25 were at the stage of sports specialization and 3 people were at the stage of improving sports skills. The study was carried out using the testing method and the method of statistical processing. After analyzing the data obtained, we can talk about the positive influence of the process of mastering the chess game on the psychophysical status of young people with cerebral palsy. This kind of sport increased the level of their sports training, their resistance to stress and steadily improved the general psychosomatic state. Even taking into account the developing decrease in the values of the considered indicators at the control stage of the study, the subjects had an increase of 13.7% in comparison with the preliminary stage of the study.

Keywords: Chess, Sports, Cerebral-palsy, Young age, Functionality

Introduction

The steady development of medicine in the modern world has not yet reduced the widespread prevalence of general pathological burden (Amelina and Medvedev, 2009; Medvedev and Savchenko, 2010). Currently, one of the most common pathologies are various disorders of the musculoskeletal system (Bespalov *et al.*, 2018a; Medvedev, 2018a; Rajalaxmi *et al.*,

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2020; Mohammed *et al.*, 2021). Various degenerative changes in the joints and vascular dysfunctions (Medvedev, 2018b; Medvedev, 2018c), based on vasospasm and their thrombosis, often leading to the development of stroke, lead to the development of dysfunction of the locomotion organs in middle-aged and older persons (Medvedev, 2018d). In young people, trauma and cerebral palsy are serious causes of movement disorders. It is the latter pathology that can cause persistent impairment of motor functions until the onset of disability. The frequent occurrence of this pathology in the population is a strong stimulus for the development of modern science and practice (Karpov *et al.*, 2020).

Medicine is continuously improving medications that stimulate the brain (Makhov and Medvedev, 2021), and also develops rehabilitation approaches that can have a different degree of pronounced healing effect (Medvedev *et al.*, 2021). Taking into account the experience already accumulated earlier, it can be argued that the dosed activation of muscles and the brain has a strong stimulating effect on the body, especially in case of various brain lesions (Mal *et al.*, 2020; Medvedev, 2021). It has been noticed that regular mental loads are an effective means of healing with cerebral dysfunctions, including infantile cerebral palsy (Mal *et al.*, 2018; Fayzullina *et al.*, 2020).

Recently, regular mental exercises are considered as an important component of the rehabilitation of patients with organic brain disorders (Makurina *et al.*, 2020). Strengthening thought processes stimulates cerebral blood flow, relieves arterial spasms, eliminates brain tissue hypoxia and minimizes the risk of stroke, thereby increasing the quality and duration of a person's life (Vorobyeva *et al.*, 2020; Vorobyeva and Medvedev, 2020).

A very effective option for enhancing brain activity is considered to be playing chess. On the one hand, they largely minimize the disorders in the human brain, and on the other hand, they prevent the deterioration of his condition in the future (Bespalov *et al.*, 2018b; Agronina *et al.*, 2020).

Modern chess has become a very accessible occupation, inextricably linked with digital technologies. Their use makes it especially widespread. It is of great interest to assess the influence of modern chess sport on the general functional characteristics of athletes with cerebral palsy.

Purpose of the Work

To assess the dynamics of general functional indicators of persons with cerebral palsy in the course of chess training.

Materials and Methods

The study was carried out with the help of the Russian Internet portal "Chess Planet", which allows one to get an idea of the actual problems of persons with disabilities during their training at the stages of sports specialization, sports improvement and higher sportsmanship. The study involved 28 people with cerebral palsy at the age of 19-27 years, out of whom 25 were at the stage of sports specialization and 3 people at the stage of improving sportsmanship, directly during the experiment and at the control stage at the end of the experimental stage. At each of the three stages of the experiment (preliminary, experimental and control), 4 series of examinations were performed (every 3 months). These surveys made it possible to draw up a picture of the dynamics of changes in the indicators taken into account throughout the year.

Changes in the state of subjects during observation were assessed using three standard tests: a test for well-being, activity and mood, a test for loneliness using the method of subjective feeling of loneliness by Russell and Ferguson, and a test for identifying personal and situational anxiety according to Spielberger's method as modified by Yu. L. Khanin.

To check the significance of the samples, the value of the Student's t-test was calculated. This was done using the null hypothesis test formula:

$$T = \frac{X_1 - X_2}{\sqrt{(m_1^2 + m_2^2)}} \qquad (1)$$

Since the calculations used the results of the same group only at different time slices, the sample size of the groups was equal to each other (n = 28). In accordance with the size of the sample and the equality of the observation groups, the number of its degrees of freedom (f) was calculated using the formula:

$$f = 2n - 2 \qquad (2)$$

Results and Discussion

As can be seen from the graph "Change in confidence coefficient" (**Figure 1**), starting from the fifth "slice", the Student's t-test exceeded its critical value ($t_{critical}$ = 2.005) in accordance with the calculated number of degrees of freedom f and the required level of significance p (for f = 54 and p <= 0.05).

Analyzing the dynamics of the average results of the subjects in the test for well-being, activity and mood, we can note a general tendency to an increase in indicators at the preliminary stage (1-4 "slice") and during training on the portal "Chess Planet "(5-9" slice "). At the preliminary stage of the study, there was a slight increase in the psychological indicators of the subjects (the results

on the "Feelings" scale to the 4th "slice" showed an increase of 3%, the results on the "Activity" scale increased by 2%, and on the "Mood" scale the average result increased by 5 %). At the same time, the indicator of a large part of the subjects was below the satisfactory level (less than 4 points).
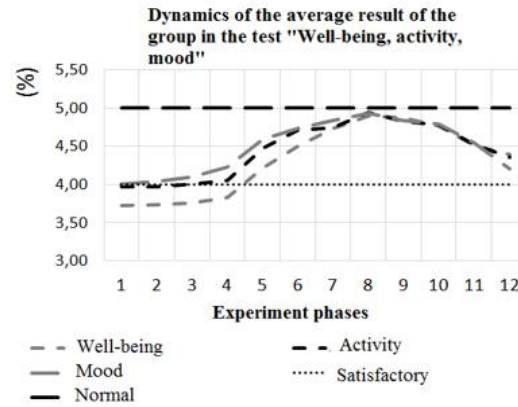

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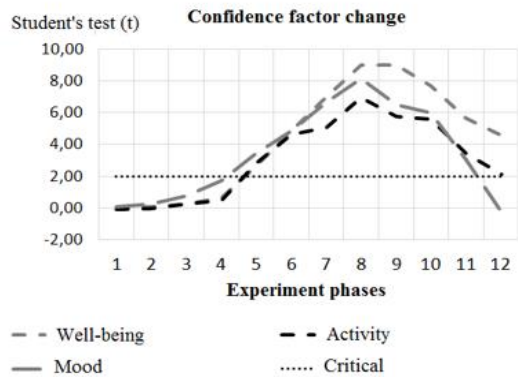
b)

Figure 1. Change in the Confidence Coefficient / Dynamics of the Average Result of the Group in the Test "Well-being, Activity, Mood"

At the next stage, based on the results of learning to play chess, there was a noticeable increase in the level of indicators of all test scales in the group. It ranged from 16 to 26% according to the results of the final testing of a series of experimental measurements, depending on the scale. The increase in the results on the "Well-being" scale was 10% at the end of the 1st "slice", 6.5% at the time of the 2nd "slice", 5% at the 3rd "slice" and another 3.5% at the final 4th "slice", the final increase the average indicator of well-being in the group was 25%. The increase in results on the "Activity" scale was 10% at the end of the 1st "slice", 5% at the time of the 2nd "slice", 1% at the 3rd "slice" and another 4% at the final 4th "slice", which ensured the final increase in the average activity in the group is 21%. The increase in the results on the "Mood" scale was 9% at the end of the 1st "slice", 3% at the moment of the 2nd "slice", 2% at the 3rd "slice" and another 2% at the final 4th "slice" with the value of the final increase in the average indicator of mood in the group 16%.

The control stage of the study, carried out after the completion of the increase in the chess mastery of the subjects, revealed that the indicators of the test subjects' state of health achieved in the course of training decrease, starting from the end of the experimental stage in connection with the termination of group chess lessons and a decrease in the involvement of the subjects of the study in the process of sports training. By the final 4th "slice", the decrease was 9% on the "Well-being" scale, 10% on the "Activity" scale, and 13% on the "Mood" scale.
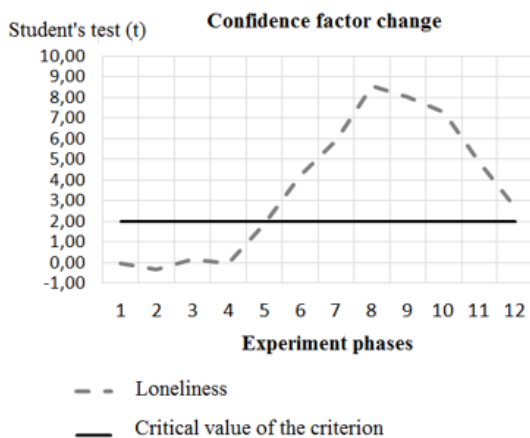
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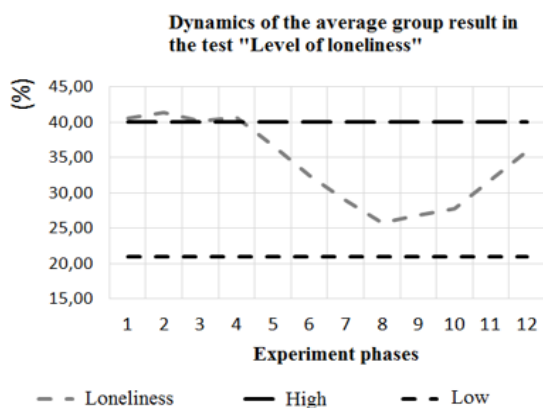
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Figure 2. Change in the Confidence Coefficient / Dynamics of the Average Group Result in the Test "The Level of Loneliness"
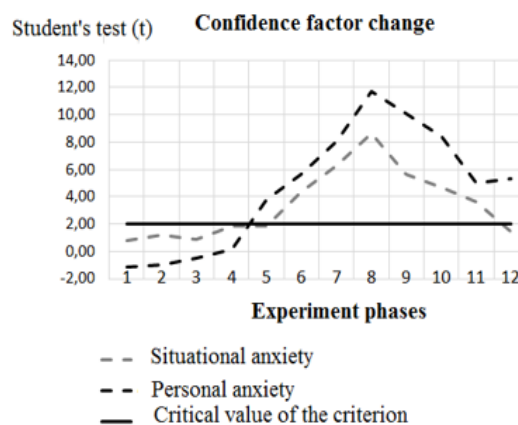
From the graph "Change in the confidence coefficient" **(Figure 2)** starting from the fifth "slice" it can be seen that the Student's t-test exceeds its critical value ($t_{critical} = 2.005$) in accordance with the calculated number of degrees of freedom f and the required level of significance p (for f = 54 and p < = 0.05).

Analyzing the dynamics of the average results of the subjects in the test for loneliness, carried out according to the method of subjective feeling of loneliness by Russell and Ferguson, we can note a general tendency for this indicator to fall during training on the Chess Planet portal (5-9 "slice").

At the preliminary stage of testing, the level of loneliness in the group was stable in all four tests. The values of the arithmetic mean points of the group during the preliminary measurements ranged from 40.1 to 41.3, which is about 3%.

At the next stage, according to the results of training, a significant decrease in the average level of loneliness of the subjects was observed in comparison with preliminary measurements, which ranged from 19 to 24% at all stages of testing. Already with the 2nd measurement of the experimental series, the number of subjects with a high level of loneliness decreased more than threefold - from 15 (on the 4th measurement of the preliminary series of tests) to 4. By the final 4th measurement, the number of subjects with a high level of loneliness reached 0. At the same time, there was a significant increase in the number subjects with an average level of loneliness up to 24 people by the 4th measurement, and this accounted for more than 90% of the total number of subjects and the appearance of individuals with its low level. This indicated an improvement in the psycho-emotional state of the subjects as a whole. By the final 4th measurement, the decrease in the average level of loneliness in the group was 43%, which in general emphasizes the positive influence of the process of chess sports training on the psychological state and the level of socialization of chess players with damage to the musculoskeletal system.

The control stage of the study, carried out after the subjects completed the training course, revealed that the decrease in the level of loneliness achieved during the stage of learning to play chess is replaced by a slight increase in the amount of 4% for 1 and 2 "slices". Starting from the third "slice", a more pronounced regression of the obtained results begins, reaching its peak at the fourth "slice" in the amount of 40%. The actual return to the level of preliminary measurements confirms the importance of continuous chess lessons as a means of systematically maintaining a satisfactory level of the psycho-emotional state of the subjects.

a)
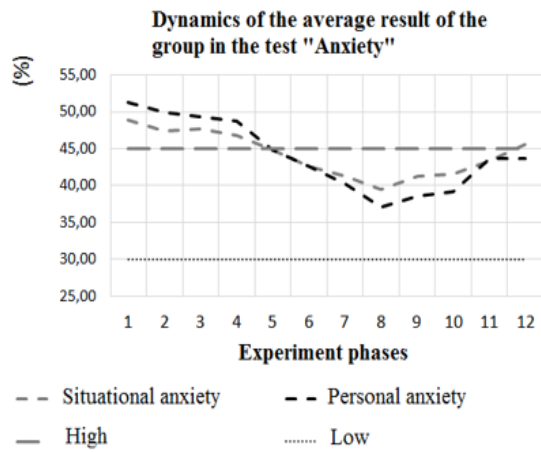
Figure 3. Change in the Confidence Coefficient / Dynamics of the Average Group Result in the Test "Anxiety"

On the graph "Confidence coefficient change" (**Figure 3**), starting from the fifth "slice", it can be seen that the Student's t-test exceeds its critical value ($t_{critical} = 2.005$) in accordance with the calculated number of degrees of freedom f and the required significance level p (for f = 54 and p <= 0.05).

Analyzing the dynamics of the average results of respondents in the test for identifying personal and situational anxiety, it is possible to note a tendency for a drop in indicators at the preliminary stage (1-4 "slice") and during training on the portal "Chess Planet" (5-9 "Slice"). At the preliminary stage of testing, there was a slight drop in the level of the group's indicators on the scale of situational and on the scale of personal anxiety by an average of 4.5%.

When assessed on the "Situational anxiety" scale, the most numerous group throughout the entire stage of preliminary measurements were those surveyed with a high level of anxiety (from 20 to 23 people). Individuals with a low level of anxiety were absent.

The results on the Personal Anxiety scale were similar. The most numerous group were also persons with a high level of anxiety (from 24 to 28 people). Those surveyed with a low level of anxiety were also absent.

At the next stage, there was a decrease in the average level of situational and personal anxiety of the subjects in comparison with preliminary measurements, which ranged from 21 to 26% at all stages of testing. The decrease in the indicator on the "Situational anxiety" scale was 8% at the end of the 1st "slice", 5% at the time of the 2nd "slice", 3% at the 3rd "slice" and another 5% at the final 4th "slice", the total decrease in the group was 21%. The decrease in the indicator on the scale "Personal anxiety" was 8% at the end of the 1st "slice", 5% at the time of the 2nd "slice", 5.5% at the 3rd "slice" and another 8% at the final 4th "slice" with a total decrease in group 26.5%.

According to the scale "Situational anxiety", starting from the second measurement, the most numerous group were those surveyed with a moderate level of anxiety. Their number grew steadily until the final measurement. The group of people with a high level of anxiety gradually decreased and decreased to 1 person by 4 measurements. At the control stage, there were no subjects with a low level of anxiety.

A similar situation was noted in the results of the application of the scale "Personal anxiety". Starting from the second measurement, the most numerous group was also made up with a moderate level of anxiety, and their number steadily increased until the final measurement. The group of chess players with a high level of anxiety gradually decreased and completely disappeared by the 4th measurement.

The control stage of the study revealed that the decrease in the level of situational and personal anxiety of the tested people, achieved with the use of the author's method, is fixed with small fluctuations at 1 and 2 "slice". However, starting from the third "slice", regression of the results obtained on both scales was revealed, reaching a maximum on the fourth "slice": on the "Situational anxiety" scale - by 16%, on the "Personal anxiety" scale - by 18%.

The complex processing of the test results was carried out in accordance with the concept of longitudinal psychography by W. Stern (Mikhaylova, 2019; Alifirov *et al.*, 2020). Content analysis, carried out in the traditional way, made it possible to interpret the psychophysical preparedness of chess players and present it in the form of a general ray psychogram (**Figure 4**) (Glamazdin *et al.*, 2021).
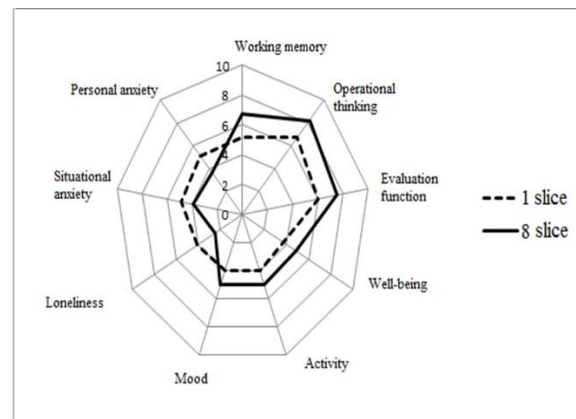
Figure 4. Psychogram of the Observed Group

The presented psychogram reflects the dynamics of the development of mnemonic capabilities, intellectual functions, psychological properties and psycho-emotional state of the personality of athletes in the first and final (eighth) sections of the study. For the convenience of a comprehensive analysis, the values of all parameters were traditionally converted into a ten-point assessment scale (Bratanovskii *et al.*, 2020; Tkacheva and Medvedev, 2020).

Analyzing the scales of psychophysical qualities of the subjects, we can note a general improvement (from 10 to 16%) in all indicators, which indicates the complexity of improving the psychophysical indicators of the surveyed, which is a positive prognostic sign (Bratanovskii *et al.*, 2020).

So the scales "Working memory", "Operational thinking" and "Evaluation function" by the 8th slice of the experiment showed an increase of 1.5 points for each indicator. The scales "Feelings", "Activity", "Mood" showed an increase from 1 to 1.3 points for each of the indicators. According to the scales "Loneliness", "Situational anxiety" and "Personal anxiety", a fall from 1 to 1.6 points was recorded for each considered attribute.

Conclusion

Having analyzed the data obtained in the course of the research, we can talk about the representativeness of the results obtained and about the usefulness of the process of mastering the chess game for the psychophysical status of persons with cerebral palsy. This increases their sports training, resistance to stress and improves the general psychosomatic state. Even taking into account the drop at the control stage of the study, the results taken into account in the subjects showed an increase of 13.7% compared to the level of the preliminary stage of the study.

Conflict of interest: None

Financial support: None

Ethics statement: The study was approved by the local ethics committee of the Russian State Social University on September 15, 2018 (protocol №11).

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